TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
176	tcctgacgttccccctggcggtcccctgtcgct	o
177	tcctgtcgctcctgtcgctcctgtcgct	o
178	tcctggcggggaagt	o
179	tcctgazgttgaagt	o
180	tcztgacgttgaagt	o
181	tcctagcgttgaagt	o
182	tccagacgttgaagt	o
183	tcctgacggggaagt	o
184	tcctggcggtgaagt	o
185	ggctccggggagggaatttttgtctat	o
186	atagacaaaaattcccctccccggagcc	o
187	tccatgagcttccttgagtct	rna
188	tcgtcgctgtctccgcttctt	so
189	~~tcgtcgctgtctccgcttctt~~ tcgtcgctgtctccg cttctt	s20
190	tcgagacattgcacaatcatctg	o
191	cagattgtgcaatgtctcga	o
192	tccatgtcgttcctgatgcg	o
193	gcgatgtcgttcctgatgct	o
194	gcgatgtcgttcctgatgcg	o
195	tccatgtcgttccgcgcgcg	o
196	tccatgtcgttcctgccgct	o
197	tccatgtcgttcctgtagct	o
198	gcggcgggcggcgcgcgccc	o
199	atcaggaacgtcatgggaagc	o
200	tccatgagcttcctgagtct	p-ethoxy
201	tcaacgtt	p-ethoxy
202	tcaagctt	p-ethoxy
203	tcctgtcgttcctgtcgtt	s
204	tccatgtcgttttgtcgtt	s
205	tcctgtcgttccttgtcgtt	s
206	tccttgtcgttcctgtcgtt	s
207	btccattccatgacgttcctgatgcttcca	os
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209	tcgtcgctgtctccgcttctt	s
210	tcgtcgctgtctgcccttctt	s
211	tcgtcgctgttgtcgtttctt	s
212	tcctgtcgttcctgtcgttggaacgacagg	o
213	tcctgtcgttcctgtcgtttcaacgtcaggaacgacagga	o
214	ggggtctgtcgttttgggggg	sos
215	ggggtctgtgcttttgggggg	sos
216	tccggccgttgaagt	o
217	tccggacggtgaagt	o
218	tcccgccgttgaagt	o
219	tccagacggtgaagt	o
220	tcccgacggtgaagt	o
221	tccagagcttgaagt	o
222	tccatgtzgttcctgtzgtt	s
223	tccatgacgttcctgacgtt	sos
224	ggggttgacgttttgggggg	sos
225	tccaggacttctctcaggtt	s
226	ttttttttttttttttttt	s
227	tccatgccgttcctgccgtt	s
228	tccatggcgggcctggcggg	s
229	tccatgacgttcctgccgtt	s
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232	tccatgacggtcctgacggt	s
233	tccatgcgtgcgtgcgtttt	s
234	tccatgcgttgcgttgcgtt	s
235	btccattccattctaggcctgagtcttccat	os
236	tccatagcgttcctagcgtt	o
237	tccatgtcgttcctgtcgtt	o
238	tccatagcgatcctagcgat	o
239	tccattgcgttccttgcgtt	o
240	tccatagcggtcctagcggt	o
241	tccatgattttcctgcagttcctgatttt	
242	tccatgacgttcctgcagttcctgacgtt	s
243	ggcggcgccggcggcggcgg	o
244	tccacgacgttttcgacgtt	s
245	tcgtcgttgtcgttgtcgtt	s
246	tcgtcgttttgtcgttttgtcgtt	s
247	tcgtcgttgtcgttttgtcgtt	s
248	gcgtgcgttgtcgttgtcgtt	s
249	czggczggczgggczccgg	o

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
250	gcggcgggcggcgcgcgccc	s
251	agicccgigaacgiattcac	o
252	tgtcgtttgtcgtttgtcgtt	s
253	tgtcgttgtcgttgtcgttgtcgtt	s
254	tgtcgttgtcgttgtcgttgtcgtt	s
255	tcgtcgtcgtcgtt	s
256	tgtcgttgtcgtt	s
257	ccccccccccccccccccc	s
258	tctagcgttttagcgttcc	sos
259	tgcatcccccaggccaccat	s
260	tcgtcgtcgtcgtcgtcgtcgtt	sos
261	tcgtcgttgtcgttgtcgtt	sos
262	tcgtcgttttgtcgttttgtcgtt	sos
263	tcgtcgttgtcgttttgtcgtt	sos
264	ggggagggaggaacttcttaaaattccccccagaatgttt	o
265	aaacattctgggggaattttaagaagttcctccctcccc	o
266	atgtttacttcttaaaattcccccagaatgttt	o
267	aaacattctgggggaattttaagaagtaaacat	o
268	atgtttactagacaaaattcccccagaatgttt	o
269	aaacattctgggggaattttgtctagtaaacat	o
270	aaaattgacgttttaaaaaa	sos
271	ccccttgacgttttcccccc	sos
272	ttttcgttgtttttgtcgtt	
273	tcgtcgttttgtcgttttgtcgtt	sos
274	ctgcagcctgggac	o
275	acccgtcgtaattatagtaaaaccc	o
276	ggtacctgtggggacattgtg	o
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279	tccatgacggtcctgacggt	o
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281	tccatgcgcgtcctgcgcgt	o
282	ctggtctttctggtttttttctgg	s
283	tcaggggtgggggaaccttt	sos
284	tccatgazgttcctagttct	o
285	tccatgatgttcctagttct	o
286	cccgaagtcatttcctcttaacctgg	o
287	ccaggttaagaggaaatgacttcggg	o
288	tcctggzggggaagt	o
289	gzggzgggzggzgzgzgccc	x
290	tccatgtgcttcctgatgct	o
291	tccatgtccttcctgatgct	
292	tccatgtcgttcctagttct	
293	tccaagtagttcctagttct	o
294	tccatgtagttcctagttct	o
295	tcccgcgcgttccgcgcgtt	s
296	tcctggcggtcctggcggtt	s
297	tcctggaggggaagt	o
298	tcctgggggggaagt	o
299	tcctggtggggaagt	o
300	tcgtcgttttgtcgttttgtcgtt	o
301	ctggtctttctggtttttttctgg	o
302	tccatgacgttcctgacgtt	o
303	tccaggacttctctcaggtt	sos
304	tzgtzgttttgtzgttttgtzgtt	o
305	btcgtcgttttgtcgttttgtcgttttttt	os
306	gctatgacgttccaaggg	s
307	tcaacgtt	s
308	tccaggactttcctcaggtt	o
309	ctctctgtaggcccgcttgg	s
310	ctttccgttggacccctggg	s
311	gtccgggccaggccaaagtc	s
312	gtgcgcgcgagcccgaaatc	s
313	tccatgaigttcctgaigtt	s
314	aatagtcgccataacaaaac	o
315	aatagtcgccatggcggggc	o
316	bttttccatgtcgttcctgatgcttttt	os
317	tcctgtcgttgaagtttttt	o
318	gctagctttagagctttagagctt	o
319	tgctgcttcccccccccccc	o
320	tcgacgttcccccccccccc	o
321	tcgtcgttcccccccccccc	o
322	tcgtcgttcccgaccccgac	o
323	tcgccgttcccccccccccc	o

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
324	tcgtcgatcccccccccccc	o
325	tcctgacgttgaagt	s
326	tcctgccgttgaagt	s
327	tcctgacggtgaagt	s
328	tactgagcttgaagt	s
329	tcctggcggggaagt	s
330	aaaatctgtgattttaaaaaa	sos
331	gatccagtcacagtgacctggcagaatctggat	o
332	gatccagattctgccaggtcactgtgactggat	o
333	gatccagtcacagtgactcagaagaatctggat	o
334	gatccagattctgctgagtcactgtgactggat	o
335	tcgtcgttcccccccccccc	o
336	tzgtggttcccccccccccc	o
337	tzgtcgttcccccccccccc	o
338	tcgtzgttcccccccccccc	o
339	tcgtcgctcccccccccccc	o
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347	tcgtcattcccccccccccc	o
348	acgtcgttcccccccccccc	o
349	ctgtcgttcccccccccccc	o
350	bttttcgtcgttcccccccccccc	os
351	tcgtcgttcccccccccccb	o
352	tcgtcgttttgtcgttttgtcgttb	o
353	tccagttccttcctcagtct	o
354	tzgtcgttttgtcgttttgtcgtt	o
355	tcctggaggggaagt	s
356	tcctgaaaaggaagt	s
357	tcgtcgttcccccccc	s
358	tzgtzgttttgtzgttttgtzgtt	s
359	ggggtcaagcttgaggggg	sos
360	tgctgcttcccccccccccc	s
361	tcgtcgtcgtcgtt	s2
362	tcgtcgtcgtcgtt	s20
363	tcgtcgtcgtcgtt	os2
364	tcaacgttga	s
365	tcaacgtt	s
366	atagttttccatttttttac	
367	aatagtcgccatcgcgcgac	o
368	aatagtcgccatcccgggac	o
369	aatagtcgccatcccccccc	o
370	tgctgcttttgtgcttttgtgctt	o
371	ctgtgctttctgtgtttttctgtg	s
372	ctaatctttctaatttttttctaa	s
373	tcgtcgttggtgtcgttggtgtcgtt	s
374	tcgtcgttggttgtcgttttggtt	s
375	accatggacgagctgtttcccctc	
376	tcgtcgttttgcgtgcgttt	s
377	ctgtaagtgagcttggagag	
378	gagaacgctggaccttcc	
379	cgggcgactcagtctatcgg	
380	gttctcagataaagcggaaccagcaacagacacagaa	
381	ttctgtgtctgttgctggttccgctttatctgagaac	
382	cagacacagaagcccgatagacg	
383	agacagacacgaaacgaccg	
384	gtctgtcccatgatctcgaa	
385	gctggccagcttacctcccg	
386	ggggcctctatacaacctggg	
387	ggggtccctgagactgcc	
388	gagaacgctggaccttccat	
389	tccatgtcggtcctgatgct	
390	ctcttgcgacctggaaggta	
391	aggtacagccaggactacga	
392	accatggacgacctgtttcccctc	
393	accatggattacctttttcccctt	
394	atggaaggtccagcgttctc	o
395	agcatcaggaccgacatgga	o
396	ctctccaagctcacttacag	
397	tccctgagactgccccacctt	

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
471	tcagctctggtacttttttca	
472	tggttacggtctgtcccatg	
473	gtctatcggaggactggcgc	
474	cattttacgggcgggcgggc	
475	gaggggaccattttacgggc	
476	tgtccagccgaggggaccat	
477	cgggcttacggcggatgctg	
478	tggaccttctatgtcggtcc	
479	tgtcccatgtttttagaagc	
480	gtggttacggtcgtgcccat	
481	cctccaaatgaaagacccccc	
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486	ttgccccatattttagaaac	
487	ttgaaactgaggtgggac	
488	ctatcggaggactggcgcgcc	
489	cttggagggcctcccggcgg	
490	gctgaaccttccatgctgtt	
491	tagaaacagcattcttcttttagggcagcaca	
492	agatggttctcagataaagcggaa	
493	ttccgctttatctgagaaccatct	
494	gtcccaggttgtatagaggctgc	
495	gcgccagtcctccgatagac	
496	atcggaggactggcgcgccg	
497	ggtctgtcccatatttttag	SOS
498	tttttcaacgttgaggggggg	SOS
499	ttttcaagcgttgatttttt	SOS
500	ggggtcaacgttgatttttt	SOS
501	ggggttttcaacgttttgaggggggg	SOS SOS
502	ggttacggtctgtcccatat	
503	ctgtcccatattttagaca	
504	accatcctgaggccattcgg	
505	cgtctatcgggcttctgtgtctg	
506	ggccatcccacattgaaagtt	
507	ccaaatatcggtggtcaagcac	
508	gtgcttgaccaccgatatttgg	
509	gtgctgatcaccgatatcctgttcgg	
510	ggccaactttcaatgtgggatggcctc	
511	ttccgccgaatggcctcaggatggtac	
512	tatagtccctgagactgccccaccttctcaacaacc	
513	gcagcctctatacaacctgggacggga	
514	ctatcggaggactggcgcgccg	
515	tatcggaggactggcgcgccg	
516	gatcggaggactggcgcgccg	
517	ccgaacaggatatcggtgatcagcac	
518	ttttggggtcaacgttgaggggggg	
519	ggggtcaacgttgaggggggg	SOS
520	cgcgcgcgcgcgcgcgcgcg	S
521	ggggcatgacgttcgggggg	SS
522	ggggcatgacgttcaaaaas	S
523	ggggcatgagcttcgggggg	S
524	ggggcatgacgttcgggggg	SOS
525	aaaacatgacgttcaaaaaa	SOS
526	aaaacatgacgttcgggggg	SOS
527	ggggcatgacgttcaaaaaa	SOS
528	accatggacgatctgtttcccctc	S
529	gccatggacgaactgttcccccctc	S
530	ccccccccccccccccccc	SOS
531	gggggggggggggggggggg	SOS
532	gctgtaaaatgaatcggccg	SOS
533	ttcgggcggactcctccatt	SOS
534	tatgccgcgcccggacttat	SOS
535	ggggtaatcgatcaggggggg	SOS
536	tttgagaacgctggaccttc	SOS
537	gatcgctgatctaatgctcg	SOS
538	gtcggtcctgatgctgttcc	SOS
539	tcgtcgtcagttcgctgtcg	SOS
540	ctggaccttccatgtcgg	SOS
541	gctcgttcagcgcgtct	SOS
542	ctggaccttccatgtc	SOS
543	cactgtccttcgtcga	SOS
544	cgctggaccttccatgtcgg	SOS

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
545	gctgagctcatgccgtctgc	sos
546	aacgctggaccttccatgtc	sos
547	tgcatgccgtacacagctct	sos
548	ccttccatgtcggtcctgat	sos
549	tactcttcggatcccttgcg	sos
550	ttccatgtcggtcctgat	sos
551	ctgattgctctctcgtga	sos
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553	cctacgttgtatgcgcccagct	o
554	ggggtaatcgatgagggggg	o
555	ttcgggcggactcctccatt	o
556	ttttttttttttttttttt	o
557	gggggttttttttttggggg	o
558	tttttgggggggggttttt	o
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560	aaaaaaaaaaaaaaaaaaaa	o
561	cccccaaaaaaaaaccccc	o
562	aaaaaccccccccccaaaaa	o
563	tttgaattcaggactggtgaggttgag	o
564	tttgaatcctcagcggtctccagtggc	o
565	aattctctatcggggcttctgtgtctgttgctggttccgctttat	o
566	ctagataaagcggaaccagcaacagacacagaagccccgatagag	o
567	ttttctagagaggtgcacaatgctctgg	o
568	tttgaattccgtgtacagaagcgagaagc	o
569	tttgcggccgctagacttaactgagagata	o
570	tttgggcccacgagagacagagacacttc	o
571	tttgggcccgcttctcgcttctgtacacg	o
572	gagaacgctggaccttccat	s
573	tccatgtcggtcctgatgct	s
574	ctgtcg	s
575	tcgtga	s
576	cgtcga	s
577	agtgct	s
578	ctgtcg	o
579	agtgct	o
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584	gagaacgctcgaccttccat	o
585	gagaacgctggacctatccat	o
586	gctagaggttagcgtga	o
587	gagaacgctggacttccat	o
588	tcacgctaacgtctagc	o
589	bgctagacgttagcgtga	o
590	atggaaggtcgagcgttctc	o
591	gagaacgctggaccttcgat	o
592	gagaacgatggaccttccat	o
593	gagaacgctggatccat	o
594	gagaacgctccagcactgat	o
595	tccatgtcggtcctgctgat	o
596	atgtcctcggtcctgatgct	o
597	gagaacgctccaccttccat	o
598	gagaacgctggaccttcgta	o
599	batggaaggtccagcgttctc	o
600	tcctga	o
601	tcaacgtt	o
602	aacgtt	o
603	aacgttga	o
604	tcacgctaacctctagc	o
605	gagaacgctggaccttgcat	o
606	gctggaccttccat	o
607	gagaacgctggacctcatccat	o
608	gagaacgctggacgctcatccat	o
609	aacgttgaggggcat	o
610	atgcccctcaacgtt	o
611	tcaacgttga	o
612	gctggaccttccat	o
613	caacgtt	o
614	acaacgttga	o
615	tcacgt	o
616	tcaagctt	o
617	tcgtca	o
618	aggatatc	o

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
619	tagacgtc	o
620	gacgtcat	o
621	ccatggat	o
622	atcgatgt	o
623	atgcatgt	o
624	ccatgcat	o
625	agcgctga	o
626	tcagcgct	o
627	ccttcgat	o
628	gtgccggggtctccgggc	o
629	gctgtggggcggctcctg	s
630	btcaacgtt	o
631	ftcaacgtt	o
632	faacgttga	o
633	tcaacgt	s
634	aacgttg	s
635	cgacga	o
636	tcaacgtt	o
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641	ccaacgtt	s
642	gctcga	s
643	cgacgt	s
644	cgtcgt	s
645	acgtgt	s
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647	gagcaagctggaccttccat	s
648	cgcgta	s
649	cgtacg	s
650	tcaccggt	s
651	caagagatgctaacaatgca	s
652	acccatcaatagctctgtgc	s
653	ccatcgat	o
654	tcgacgtc	o
655	ctagcgct	o
656	taagcgct	o
657	tcgcgaattcgcg	o
658	atggaaggtccagcgttct	o
659	actggacgttagcgtga	o
660	cgcctggggctggtctgg	o
661	gtgtcggggtctccgggc	o
662	gtgccggggtctccgggc	o
663	cgccgtcgcggcggttgg	o
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665	atctggtgagggcaagctatg	s
666	gttgaaacccgagaacatcat	s
667	gcaacgtt	o
668	gtaacgtt	o
669	cgaacgtt	o
670	gaaacgtt	o
671	caaacgtt	o
672	ctaacgtt	o
673	ggaacgtt	o
674	tgaacgtt	o
675	acaacgtt	o
676	ttaacgtt	o
677	aaaacgtt	o
678	ataacgtt	o
679	aacgttct	o
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681	tccgtacg	o
682	gctagacgctagcgtga	o
683	gagaacgttggacctcatcatccat	o
684	gagaacgttagaccttctat	o
685	actagacgttagtgtga	o
686	cacaccttggtcaatgtcacgt	o
687	tctccatcctatggttttatcg	o
688	cgctggagcttccat	o
689	caccaccttggtcaatgtcacgt	o
690	gctagacgttagctgga	o
691	agtgcgattgcagatcg	o
692	ttttcgttttgtggttttgtggtt	

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
693	ttttcgtttgtcgttttgtcgtt	
694	tttttgttttgtggttttgtggtt	
695	accgcatggattctaggcca	s
696	gctagacgttagcgt	o
697	aacgctggaccttccat	o
698	tcaazgtt	o
699	ccttcgat	o
700	actagacgttagtgtga	s
701	gctagaggttagcgtga	s
702	atggactctccagcgttctc	o
703	atcgactctcgagcgttctc	o
704	gctagacgttagc	o
705	gctagacgt	o
706	agtgcgattcgagatcg	o
707	tcagzgct	o
708	ctgattgctctctcgtga	o
709	tzaacgtt	o
710	gagaazgctggaccttccat	o
711	gctagacgttaggctga	o
712	gctacttagcgtga	o
713	gctaccttagcgtga	o
714	atcgacttcgagcgttctc	o
715	atgcactctgcagcgttctc	o
716	agtgactctccagcgttctc	o
717	gccagatgttagctgga	o
718	atcgactcgagcgttctc	o
719	atcgatcgagcgttctc	o
720	bgagaacgctcgaccttcgat	o
721	gctagacgttagctgga	sos
722	atcgactctcgagcgttctc	sos
723	tagacgttagcgtga	o
724	cgactctcgagcgttctc	o
725	ggggtcgaccttggaggggg	sos
726	gctaacgttagcgtga	o
727	cgtcgtcgt	o
728	gagaazgctggacztccat	o
729	atcgacctacgtgcgttztc	o
730	atzgacctacgtgcgttctc	o
731	gctagazgttagcgt	o
732	atcgactctcgagzgttctc	o
733	ggggtaatgcatcaggggg	sos
734	ggctgtattcctgactgccc	s
735	ccatgctaacctctagc	o
736	gctagatgttagcgtga	o
737	cgtaccttacggtga	o
738	tccatgctggtcctgatgct	o
739	atcgactctctcgagcgttctc	o
740	gctagagcttagcgtga	o
741	atcgactctcgagtgttctc	o
742	aacgctcgaccttcgat	o
743	ctcaacgctggaccttccat	o
744	atcgacctacgtgcgttctc	o
745	gagaatgctggaccttccat	o
746	tcacgctaacctctgac	o
747	bgagaacgctccagcactgat	o
748	bgagcaagctggaccttccat	o
749	cgctagaggttagcgtga	o
750	gctagatgttaacgt	o
751	atggaaggtccacgttctc	o
752	gctagatgttagcgt	o
753	gctagacgttagtgt	o
754	tccatgacggtcatgatgct	o
755	tccatggcggtcctgatgct	o
756	gctagacgatagcgt	o
757	gctagtcgatagcgt	o
758	tccatgacgttcctgatgct	o
759	tccatgtcgttcctgatgct	o
760	gctagacgttagzgt	o
761	gctaggcgttagcgt	o
762	tccatgtzggtcctgatgct	o
763	tccatgtcggtzctgatgct	o
764	atzgactctzgagzgttctc	o
765	atggaaggtccagtgttctc	o
766	gcatgacgttgagct	o

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
767	ggggtcaacgttgaggggg	s
768	ggggtcaagtctgaggggg	sos
769	cgcgcgcgcgcgcgcgcgcg	o
770	ccccccccccccccccccccccccc	s
771	ccccccccccccccccccccccccccccccccc	s
772	tcaatgtcgctcctgatcct	o
773	gctaaacgttagcgt	o
774	tccatgtcgatcctgatgct	o
775	tccatgccggtcctgatgct	o
776	aaaatcaacgttgaaaaaaa	sos
777	tccataacgttcctgatgct	o
778	tggaggtcccaccgagatcggag	o
779	cgtcgtcgtcgtcgtcgtcgt	s
780	ctgctgctgctgctgctgctg	s
781	gagaacgctccgaccttcgat	s
782	gctagatgttagcgt	s
783	gcatgacgttgagct	s
784	tcaatgctgaf	o
785	tcaacgttgaf	o
786	tcaacgttgab	o
787	gcaatattgcb	o
788	gcaatattgcf	o
789	agttgcaact	o
790	tcttcgaa	o
791	tcaacgtc	o
792	ccatgtcggtcctgatgct	o
793	gtttttatataatttggg	o
794	tttttgtttgtcgttttgtcgtt	o
795	ttgggggggtt	s
796	ggggttgggggtt	s
797	ggtggtgtaggttttgg	o
798	bgagaazgctcgaccttagat	o
799	tcaacgttaacgttaacgtt	o
800	bgagcaagztggaccttccat	o
801	bgagaazgctccagcactgat	o
802	tcaazgttgax	o
803	gzaatattgcx	o
804	tgctgcttttgtcgttttgtgctt	o
805	ctgcgttagcaatttaactgtg	o
806	tccatgacgttcctgatgct	s
807	tgcatgccgtgcatccgtacacagctct	s
808	tgcatgccgtacacagctct	s
809	tgcatcagctct	s
810	tgcgctct	s
811	ccccccccccccccccccc	s
812	cccccccccccc	s
813	cccccccc	s
814	tgcatcagctct	sos
815	tgcatgccgtacacagctct	o
816	gagcaagctggaccttccat	s
817	tcaacgttaacgttaacgttaacgttaacgtt	s
818	gagaacgctcgaccttcgat	s
819	gtccccatttcccagaggaggaaat	o
820	ctagcggctgacgtcatcaagctag	o
821	ctagcttgatgacgtcagccgctag	o
822	cggctgacgtcatcaa	s
823	ctgacgtg	o
824	ctgacgtcat	o
825	attcgatcggggcggggcgag	o
826	ctcgccccgccccgatcgaat	o
827	gactgacgtcagcgt	o
828	ctagcggctgacgtcataaagctagc	s
829	ctagctttatgacgtcagccgctagc	s
830	ctagcggctgagctcataaagctagc	s
831	ctagtggctgacgtcatcaagctag	s
832	tccaccacgtggtctatgct	s
833	gggaatgaaagattttattataag	o
834	tctaaaaaccatctattcttaaccct	o
835	agctcaacgtcatgc	o
836	ttaacggtggtagcggtattggtc	o
837	ttaagaccaataccgctaccaccg	o
838	gatctagtgatgagtcagccggatc	o
839	gatccggctgactcatcactagatc	o
840	tccaagacgttcctgatgct	o

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
841	tccatgacgtcctgatgct	o
842	tccaccacgtggctgatgct	o
843	ccacgtggacctctagc	o
844	tcagaccacgtggtcgggtgttcctga	o
845	tcaggaacacccgaccacgtggtctgt	o
846	catttccacgatttccca	o
847	ttcctcttgcaagagact	o
848	tgtatctctctgaaggact	o
849	ataaagcgaaactagcagcagtttc	o
850	gaaactgctgctagtttcgctttat	o
851	tgcccaaagaggaaaatttgtttcatacag	o
852	ctgtatgaaacaaattttcctttgggca	o
853	ttagggttagggttagggtt	ss
854	tccatgagcttcctgatgct	ss
855	aaaacatgacgttcaaaaaa	ss
856	aaaacatgacgttcgggggg	ss
857	ggggcatgagcttcgggggg	sos
858	ctaggctgacgtcatcaagctagt	o
859	tctgacgtcatctgacgttggctgacgtct	o
860	ggaattagtaatagatatagaagtt	o
861	tttacctttataaacataactaaaacaaa	o
862	gcgtttttttttgcg	s
863	atatctaatcaaaacattaacaaa	o
864	tctatcccaggtggttcctgttag	o
865	btccatgacgttcctgatgct	o
866	btccatgagcttcctgatgct	o
867	tttttttttttttf	o
868	ttttttttttttf	so
869	ctagcttgatgagctcagccgctag	o
870	ttcagttgtcttgctgcttagctaa	o
871	ttcatgagcttcctgagtct	s
872	ctagcggctgacgtcatcaatctag	o
873	tgctagctgtgcctgtacct	s
874	atgctaaaggacgtcacattgca	o
875	tgcaatgtgacgtcctttagcat	o
876	gtaggggactttccgagctcgagatcctatg	o
877	cataggatctcgagctcggaaagtcccctac	o
878	ctgtcaggaactgcaggtaagg	o
879	cataacataggaatatttactcctcgc	o
880	ctccagctccaagaaaggacg	o
881	gaagtttctggtaagtcttcg	o
882	tgctgcttttgtgcttttgtgctt	s
883	tcgtcgttttgtggttttgtggtt	s
884	tcgtcgtttgtcgttttgtcgtt	s
885	tcctgacgttcggcgcgcgccc	s
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887	tccatgagcttcctgagctt	s
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891	ttcgtcgttttgtcgttttgtcgtt	s
892	tcctgacggggaagt	s
893	tcctggcgtggaagt	s
894	tcctggcggtgaagt	s
895	tcctggcgttgaagt	s
896	tcctgacgtggaagt	s
897	ggacgttcggcgcgcgccc	s
898	gcgacgggcggcgcgcgccc	s
899	gcggcgtgcggcgcgcgccc	s
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901	gcgacggtcggcgcgcgccc	s
902	gcggcgttcggcgcgcgccc	s
903	gcgacgtgcggcgcgcgccc	s
904	tcgtcgctgtctccg	s
905	tgtgggggttttggttttgg	s
906	aggggaggggaggggaggggg	s
907	tgtgtgtgtgtgtgtgtgtgt	s
908	ctctctctctctctctctctct	chimeric
909	ggggtcgacgtcgaggggggg	s
910	atatatatatatatatatatat	s
911	ttttttttttttttttttttttttttt s	
912	tttttttttttttttttttt	s
913	ttttttttttttttttt s	
914	gctagaggggagggt	

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
915	gctagatgttaggggg	
916	gcatgaggggagct	
917	atggaaggtccaggggctc	
918	atggactctggaggggctc	
919	atggaaggtccaaggggctc	
920	gagaaggggggaccttggat	
921	gagaaggggggaccttccat	
922	gagaagggccagcactgat	
923	tccatgtggggcctgatgct	
924	tccatgaggggcctgatgct	
925	tccatgtggggcctgctgat	
926	atggactctccggggttctc	
927	atggaaggtccggggttctc	
928	atggactctggaggggtctc	
929	atggaggctccatggggctc	
930	atggactctgggggggttctc	
931	tccatgtgggtggggatgct	
932	tccatgcgggtggggatgct	
933	tccatggggtcctgatgct	
934	tccatggggtccctgatgct	
935	tccatggggtgcctgatgct	
936	tccatggggttcctgatgct	
937	tccatcgggggcctgatgct	
938	gctagagggagtgt	
939	ttttttttttttttttt	s
940	gmggtcaacgttgagggmggg	s
941	ggggagttcgttgaggggggg	s
942	tcgtcgttttccccccccc	s
943	ttgggggggttttttttttttttttt	s
944	tttaaattttaaaatttaaaata	s
945	ttggttttttggttttttttgg	s
946	tttccctttcccctttcccctc	s
947	ggggtcatcgatgagggggg s	sos
948	tccatgacgttcctgacgtt	
949	tccatgacgttcctgacgtt	
950	tccatgacgttcctgacgtt	
951	tccatgacgttcctgacgtt	
952	tccatgacgttcctgacgtt	
953	tccatgacgttcctgacgtt	
954	tccatgacgttcctgacgtt	
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956	tccatgacgttcctgacgtt	
957	tccatgacgttcctgacgtt	
958	tccatgacgttcctgacgtt	
959	gggggacgatcgtcgggggg	sos
960	gggggtcgtacgacgggggg	sos
961	ttttttttttttttttttttttttt	po
962	aaaaaaaaaaaaaaaaaaaaaaaaa	po
963	ccccccccccccccccccccccccc	po
964	tcgtcgttttgtcgttttgtcgtt	
965	tcgtcgttttgtcgttttgtcgtt	
966	tcgtcgttttgtcgttttgtcgtt	
967	tcgtcgttttgtcgttttgtcgtt	
968	ggggtcaacgttgaggggggg	
969	ggggtcaacgttgaggggggg	
970	ggggtcaagcttgaggggggg	
971	tgctgcttcccccccccccc	
972	ggggacgtcgacgtgggggg	sos
973	ggggtcgtcgacgaggggggg	sos
974	ggggtcgacgtacgtcgaggggggg	sos
975	ggggaccggtaccggtgggggg	sos
976	gggtcgacgtcgaggggggg	sos
977	ggggtcgacgtcgaggggggg	sos
978	ggggaacgttaacgttgggggg	sos
979	ggggtcaccggtgaggggggg	sos
980	ggggtcgttcgaacgaggggggg	sos
981	ggggacgttcgaacgtgggggg	sos
982	tcaactttga	s
983	tcaagcttga	s
984	tcacgatcgtga	s
985	tcagcatgctga	s
986	gggggagcatgctgggggggg	sos
987	gggggggggggggggggggg	sos
988	gggggacgatatcgtcgggggg	sos

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
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990	ggggggacgagctcgtcgggggg	sos
991	ggggggacgtacgtcgggggg	sos
992	tcaacgtt	
993	tccataccggtcctgatgct	
994	tccataccggtcctaccggt	s
995	ggggggacgatcgttgggggg	sos
996	ggggaacgatcgtcgggggg	sos
997	ggg ggg acg atc gtc ggg ggg	sos
998	ggg gga cga tcg tcg ggg ggg	sos
999	aaa gac gtt aaa	po
1000	aaagagcttaaa	po
1001	aaagazgttaaa	po
1002	aaatt[illegible]c	po
1003	gggggtcatcgatgaggggg	sos
1004	gggggtcaacgttgaggggg	sos
1005	atgtagcttaataacaaagc	po
1006	ggatcccttgagttacttct	po
1007	ccattccacttctgattacc	po
1008	tatgtattatcatgtagata	po
1009	agcctacgtattcaccctcc	po
1010	ttcctgcaactactattgta	po
1011	atagaaggccctacaccagt	po
1012	ttacaccggtctatggaggt	po
1013	ctaaccagatcaagtctagg	po
1014	cctagacttgatctggttag	po
1015	tataagcctcgtccgacatg	po
1016	catgtcggacgaggcttata	po
1017	tggtggtggggagtaagctc	po
1018	gagctactcccccaccacca	po
1019	gccttcgatcttcgttggga	po
1020	tggacttctctttgccgtct	po
1021	atgctgtagcccagcgataa	po
1022	accgaatcagcggaaagtga	po
1023	tccatgacgttcctgacgtt	
1024	ggagaaacccatgagctcatctgg	
1025	accacagaccagcaggcaga	
1026	gagcgtgaactgcgcgaaga	
1027	tcggtaccettgcagcggtt	
1028	ctggagccctagccaaggat	
1029	gcgactccatcaccagcgat	
1030	cctgaagtaagaaccagatgt	
1031	ctgtgttatctgacatacacc	
1032	aattagccttaggtgattggg	
1033	acatctggttcttacttcagg	
1034	ataagtcatattttgggaactac	
1035	cccaatcacctaaggctaatt	
1036	ggggtcgtcgacgaggggggg	sos
1037	ggggtcgttcgaacgaggggggg	sos
1038	ggggacgttcgaacgtgggggg	sos
1039	tcctggcgggaagt	s
1040	ggggaacgacgtcgttgggggg	sos
1041	ggggaacgtacgtcgggggg	sos
1042	ggggaacgtacgtacgttgggggg	sos
1043	ggggtcaccggtgaggggggg	sos
1044	ggggtcgacgtacgtcgaggggggg	sos
1045	ggggaccggtaccggtgggggg	sos
1046	gggtcgacgtcgaggggggg	sos
1047	ggggtcgacgtcgaggggg	sos
1048	ggggaacgttaacgttgggggg	sos
1049	ggggacgtcgacgtggggg	sos
1050	gcactcttcgaagctacagccggcagcctctgat	
1051	cggctcttccatgaggtctttgctaatcttgg	
1052	cggctcttccatgaaagtctttggacgatgtgagc	
1053	tcctgcaggttaagt	s
1054	gggggtcgttcgttgggggg	sos
1055	gggggatgattgttgggggg	sos
1056	gggggazgatzgttgggggg	sos
1057	gggggagctagttgggggg	sos
1058	ggttcttttggtccttgtct	s
1059	ggttcttttggtcctcgtct	s
1060	ggttcttttggtccttatct	s
1061	ggttcttggtttccttgtct	s
1062	tggtcttttggtccttgtct	s

TABLE 1-continued

SEQ ID NO:	ODN SEQUENCE	BACKBONE
1063	ggttcaaatggtccttgtct	s
1064	gggtcttttgggccttgtct	s
1065	tccaggacttctctcaggtttttt	s
1066	tccaaaacttctctcaaatt	s
1067	tactacttttatacttttatactt	s
1068	tgtgtgtgtgtgtgtgtgtgtg	s
1069	ttgttgttgtgttttgttgttgttg	s
1070	ggctccggggagggaatttttgtctat	s
1071	gggacgatcgtcgggggg	sos
1072	gggtcgtcgacgaggggggg	sos
1073	ggtcgtcgacgaggggggg	sos
1074	gggtcgtcgtcgtgggggggg	sos
1075	ggggacgatcgtcgggggggg	sos
1076	ggggacgtcgtcgtgggggg	sos
1077	ggggtcgacgtcgacgtcgaggggggg	sos
1078	ggggaaccgcggttgggggg	sos
1079	ggggacgacgtcgtgggggg	sos
1080	tcgtcgtcgtcgtcgtgggggg	sos
1081	tcctgccggggaagt	s
1082	tcctgcaggggaagt	s
1083	tcctgaaggggaagt	s
1084	tcctggcgggcaagt	s
1085	tcctggcgggtaagt	s
1086	tcctggcgggaaagt	s
1087	tccgggcggggaagt	s
1088	tcggggcggggaagt	s
1089	tcccggcggggaagt	s
1090	gggggacgttggggg	s
1091	ggggtttttttttggggggg	sos
1092	ggggccccccccccgggggg	sos
1093	ggggttgttgttgttgggggg	sos

[0053] In some embodiments, the immunostimulatory nucleic acid is a CpG nucleic acid. CpG sequences, while relatively rare in human DNA are commonly found in the DNA of infectious organisms such as bacteria. The human immune system has apparently evolved to recognize CpG sequences as an early warning sign of infection and to initiate an immediate and powerful immune response against invading pathogens without causing adverse reactions frequently seen with other immune stimulatory agents. Thus CpG containing nucleic acids, relying on this innate immune defense mechanism can utilize a unique and natural pathway for immune therapy. The effects of CpG nucleic acids on immune modulation have been described extensively in published patent applications, such as PCT US95/01570), PCT/US97/19791, PCT/US98/03678; PCT/US98/10408; PCT/US98/04703; PCT/US99/07335; and PCT/US99/09863. The entire contents of each of these patent applications is hereby incorporated by reference.

[0054] A CpG nucleic acid is a nucleic acid which includes at least one unmethylated CpG dinucleotide. A nucleic acid containing at least one unmethylated CpG dinucleotide is a nucleic acid molecule which contains an unmethylated cytosine in a cytosine-guanine dinucleotide sequence (i.e. "CpG DNA" or DNA containing a 5' cytosine followed by 3' guanosine and linked by a phosphate bond) and activates the immune system. The CpG nucleic acids can be double-stranded or single-stranded. Generally, double-stranded molecules are more stable in vivo, while single-stranded molecules have increased immune activity. Thus in some aspects of the invention it is preferred that the nucleic acid be single stranded and in other aspects it is preferred that the nucleic acid be double stranded. The terms CpG nucleic acid or CpG oligonucleotide as used herein refer to an immunostimulatory CpG nucleic acid or a nucleic acid unless otherwise indicated. The entire immunostimulatory nucleic acid can be unmethylated or portions may be unmethylated but at least the C of the 5' CG 3' must be unmethylated.

[0055] In one preferred embodiment the invention provides an immunostimulatory nucleic acid which is a CpG nucleic acid represented by at least the formula:

$$5'X_1X_2CGX_3X_4 3'$$

[0056] wherein X_1, X_2,X_3, and X4 are nucleotides. In one embodiment X_2 is adenine, guanine, cytosine, or thymine. In another embodiment X_3 is cytosine, guanine, adenine, or thymine. In other embodiments X_2 is adenine, guanine, or thymine and X_3 is cytosine, adenine, or thymine.

[0057] In another embodiment the immunostimulatory nucleic acid is an isolated CpG nucleic acid represented by at least the formula:

$$5'N_1X_1X_2CGX_3X_4N_2 3'$$

[0058] wherein X_1, X_2,X_3, and X_4 are nucleotides and N is any nucleotide and N_1 and N_2 are nucleic acid sequences composed of from about 0-25 N's each. In one embodiment X_1X_2 are nucleotides selected from the group consisting of: GpT, GpG, GpA, ApA, ApT, ApG, CpT, CpA, CpG, TpA, TpT, and TpG; and X_3X_4 are nucleotides selected from the group consisting of: TpT, ApT, TpG, ApG, CpG, TpC, ApC, CpC, TpA, ApA, and CpA. Preferably X_1X_2 are GpA or GpT and X_3X_4 are TpT. In other embodiments X_1 or X_2 or both are purines and X_3 or X_4 or both are pyrimidines or X_1X_2 are GpA and X_3 or X_4 or both are pyrimidines. In another

not exclusively associated with atopic or allergic symptoms. An "initiator" as used herein refers to a composition or environmental condition which triggers asthma. Initiators include, but are not limited to, allergens, cold temperatures, exercise, viral infections, SO_2.

[0103] In another aspect the invention provides methods for treating or preventing asthma or allergy in a hypo-responsive subject. As used herein, a hypo-responsive subject is one who has previously failed to respond to a treatment directed at treating or preventing asthma or allergy or one who is at risk of not responding to such a treatment. The treatment directed at treating or preventing asthma or allergy may be an asthma/allergy medicament, in which case the hypo-responsive subject is one who is hypo-responsive to an asthma/allergy medicament.

[0104] Other subjects who are hypo-responsive include those who are refractory to an asthma/allergy medicament. As used herein, the term "refractory" means resistant or failure to yield to treatment. Such subjects may be those who never responded to an asthma/allergy medicament (i.e., subjects who are non-responders), or alternatively, they may be those who at one time responded to an asthma/allergy medicament, but have since that time have become refractory to the medicament. In some embodiments, the subject is one who is refractory to a subset of medicaments. A subset of medicaments is at least one medicament. In some embodiments, a subset refers to 2, 3, 4, 5, 6, 7, 8, 9, or 10 medicaments.

[0105] In other embodiments, hypo-responsive subjects are elderly subjects, regardless of whether they have or have not previously responded to a treatment directed at treating or preventing asthma or allergy. Elderly subjects, even those who have previously responded to such treatment, are considered to be at risk of not responding to a future administration of this treatment. Similarly, neonatal subjects are also considered to be at risk of not responding to treatment directed at treating or preventing asthma or allergy.

[0106] In some embodiments, an immunostimulatory nucleic acid is administered to the hypo-responsive subject without the further administration of an asthma/allergy medicament. In yet other embodiments, an asthma/allergy medicament is administered to the hypo-responsive subject, in which case it may be administered substantially simultaneously (i.e., concurrently) with, or following the administration of the immunostimulatory nucleic acid.

[0107] An "asthma/allergy medicament" as used herein is a composition of matter which reduces the symptoms, inhibits the asthmatic or allergic reaction, or prevents the development of an allergic or asthmatic reaction. Various types of medicaments for the treatment of asthma and allergy are described in the Guidelines For The Diagnosis and Management of Asthma, Expert Panel Report 2, NIH Publication No. 97/4051, Jul. 19, 1997, the entire contents of which are incorporated herein by reference. The summary of the medicaments as described in the NIH publication is presented below.

[0108] In most embodiments the asthma/allergy medicament is useful to some degree for treating both asthma and allergy. Some asthma/allergy medicaments are preferably used in combination with the immunostimulatory nucleic acids to treat asthma. These are referred to as asthma medicaments. Asthma medicaments include, but are not limited, PDE-4 inhibitors, bronchodilator/beta-2 agonists, K^+ channel openers, VLA-4 antagonists, neurokin antagonists, TXA2 synthesis inhibitors, xanthanines, arachidonic acid antagonists, 5 lipoxygenase inhibitors, thromboxin A2 receptor antagonists, thromboxane A2 antagonists, inhibitor of 5-lipox activation proteins, and protease inhibitors.

[0109] Bronchodilator/beta-2 agonists are a class of compounds which cause bronchodilation or smooth muscle relaxation. Bronchodilator/beta-2 agonists include, but are not limited to, salmeterol, salbutamol, albuterol, terbutaline, D2522/formoterol, fenoterol, bitolterol, pirbucrol methylxanthines and orciprenaline. Long-acting ~~P2~~ agonists and β_2 bronchodilators are compounds which are used for long-term prevention of symptoms in addition to the anti-inflammatory therapies. They function by causing bronchodilation, or smooth muscle relaxation, following adenylate cyclase activation and increase in cyclic AMP producing functional antagonism of bronchoconstriction. These compounds also inhibit mast cell mediator release, decrease vascular permeability and increase mucociliary clearance. Long-acting ~~P2~~ β_2 agonists include, but are not limited to, salmeterol and albuterol. These compounds are usually used in combination with corticosteroids and generally are not used without any inflammatory therapy. They have been associated with side effects such as tachycardia, skeletal muscle tremor, hypokalemia, and prolongation of QTc interval in overdose.

[0110] Methylxanthines, including for instance theophylline, have been used for long-term control and prevention of symptoms. These compounds cause bronchodilation resulting from phosphodiesterase inhibition and likely adenosine antagonism. It is also believed that these compounds may effect eosinophilic infiltration into bronchial mucosa and decrease T-lymphocyte numbers in the epithelium. Dose-related acute toxicities are a particular problem with these types of compounds. As a result, routine serum concentration must be monitored in order to account for the toxicity and narrow therapeutic range arising from individual differences in metabolic clearance. Side effects include tachycardia, nausea and vomiting, tachyarrhythmias, central nervous system stimulation, headache, seizures, hematemesis, hyperglycemia and hypokalemia. Short-acting β_2 agonists/bronchodilators relax airway smooth muscle, causing the increase in air flow. These types of compounds are a preferred drug for the treatment of acute asthmatic systems. Previously, short-acting β_2 agonists had been prescribed on a regularly-scheduled basis in order to improve overall asthma symptoms. Later reports, however, suggested that regular use of this class of drugs produced significant diminution in asthma control and pulmonary function (Sears, et al. *Lancet;* 336:1391-6, 1990). Other studies showed that regular use of some types of β_2 agonists produced no harmful effects over a four-month period but also produced no demonstrable effects (Drazen, et al., *N. Eng. J. Med.;* 335:841-7, 1996). As a result of these studies, the daily use of short-acting β_2 agonists is not generally recommended. Short-acting β_2 agonists include, but are not limited to, albuterol, bitolterol, pirbuterol, and terbutaline. Some of the adverse effects associated with the mastration of short-acting β_2 agonists include tachycardia, skeletal muscle tremor, hypokalemia, increased lactic acid, headache, and hyperglycemia.

agents such as adjuvants to enhance immune responses even further. The immunostimulatory nucleic acid, asthma/allergy medicament and other therapeutic agent may be administered simultaneously or sequentially. When the other therapeutic agents are administered simultaneously they can be administered in the same or separate formulations, but are administered at the same time. The other therapeutic agents are administered sequentially with one another and with the immunostimulatory nucleic acid and asthma/allergy medicament, when the administration of the other therapeutic agents and the immunostimulatory nucleic acid and asthma/allergy medicament is temporally separated. The separation in time between the administration of these compounds may be a matter of minutes or it may be longer. Other therapeutic agents include but are not limited to non-nucleic acid adjuvants, cytokines, antibodies, antigens, etc.

[0160] A "non-nucleic acid adjuvant" is any molecule or compound except for the immunostimulatory nucleic acids described herein which can stimulate the humoral and/or cellular immune response. Non-nucleic acid adjuvants include, for instance, adjuvants that create a depo effect, immune stimulating adjuvants, adjuvants that create a depo effect and stimulate the immune system and mucosal adjuvants.

[0161] An "adjuvant that creates a depo effect" as used herein is an adjuvant that causes an antigen or allergen to be slowly released in the body, thus prolonging the exposure of immune cells to the antigen or allergen. This class of adjuvants includes but is not limited to alum (e.g., aluminum hydroxide, aluminum phosphate); or emulsion-based formulations including mineral oil, non-mineral oil, water-in-oil or oil-in-water-in oil emulsion, oil-in-water emulsions such as Seppic ISA series of Montanide adjuvants (e.g., Montanide ISA 720, AirLiquide, Paris, France); MF-59 (a squalene-in-water emulsion stabilized with Span 85 and Tween 80; Chiron Corporation, Emeryville, Calif.; and PROVAX (an oil-in-water emulsion containing a stabilizing detergent and a micelle-forming agent; IDEC, Pharmaceuticals Corporation, San Diego, Calif.).

[0162] An "immune stimulating adjuvant" is an adjuvant that causes activation of a cell of the immune system. It may, for instance, cause an immune cell to produce and secrete cytokines. This class of adjuvants includes but is not limited to saponins purified from the bark of the *Q. saponaria* tree, such as QS21 (a glycolipid that elutes in the 21st peak with HPLC fractionation; Aquila Biopharmaceuticals, Inc., Worcester, Mass.); poly[di(carboxylatophenoxy)phosphazene (PCPP polymer; Virus Research Institute, USA); derivatives of lipopolysaccharides such as monophosphoryl lipid A (MPL; Ribi ImmunoChem Research, Inc., Hamilton, Mont.), muramyl dipeptide (MDP; Ribi) andthreonyl-muramyl dipeptide (t-MDP; Ribi); OM-174 (a glucosamine disaccharide related to lipid A; OM Pharma SA, Meyrin, Switzerland); and Leishmania elongation factor (a purified Leishmania protein; Corixa Corporation, Seattle, Wash.).

[0163] "Adjuvants that create a depo effect and stimulate the immune system" are those compounds which have both of the above-identified functions. This class of adjuvants includes but is not limited to ISCOMS (Immunostimulating complexes which contain mixed saponins, lipids and form virus-sized particles with pores that can hold antigen; CSL, Melbourne, Australia); SB-AS2 (SmithKline Beecham adjuvant system #2 which is an oil-in-water emulsion containing MPL and QS21: SmithKline Beecham Biologicals [SBB], Rixensart, Belgium); SB-AS4 (SmithKline Beecham adjuvant system #4 which contains alum and MPL; SBB, Belgium); non-ionic block copolymers that form micelles such as CRL 1005 (these contain a linear chain of hydrophobic polyoxypropylene flanked by chains of polyoxyethylene; Vaxcel, Inc., Norcross, Ga.); and Syntex Adjuvant Formulation (SAF, an oil-in-water emulsion containing Tween 80 and a nonionic block copolymer; Syntex Chemicals, Inc., Boulder, Colo.).

[0164] A "non-nucleic acid mucosal adjuvant" as used herein is an adjuvant other than an immunostimulatory nucleic acid that is capable of inducing a mucosal immune response in a subject when administered to a mucosal surface in conjunction with an antigen or allergen. Mucosal adjuvants include but are not limited to Bacterial toxins: e.g., Cholera toxin (CT), CT derivatives including but not limited to CT B subunit (CTB) (Wu et al., 1998, Tochikubo et al., 1998); CTD53 (Val to Asp) (Fontana et al., 1995); CTK97 (Val to Lys) (Fontana et al., 1995); CTK104 (Tyr to Lys) (Fontana et al., 1995); CTD53/K63 (Val to Asp, Ser to Lys) (Fontana et al., 1995); CTH54 (Arg to His) (Fontana et al., 1995); CTN107 (His to Asn) (Fontana et al., 1995); CTE114 (Ser to Glu) (Fontana et al., 1995); CTE112K (Glu to Lys) (Yamamoto et al., 1997a); CTS61F (Ser to Phe) (Yamamoto et al., 1997a, 1997b); CTS106 (Pro to Lys) (Douce et al., 1997, Fontana et al., 1995); andCTK63 (Ser to Lys) (Douce et al., 1997, Fontana et al., 1995), Zonula occludens toxin, zot, *Escherichia coli* heat-labile enterotoxin, Labile Toxin (LT), LT derivatives including but not limited to LT B subunit (LTB) (Verweij et al., 1998); LT7K (Arg to Lys) (Komase et al., 1998, Douce et al., 1995); LT61F (Ser to Phe) (Komase et al., 1998); LT112K (Glu to Lys) (Komase et al., 1998); LT118E (Gly to Glu) (Komase et al., 1998); LT146E (Arg to Glu) (Komase et al., 1998); LT192G (Arg to Gly) (Komase et al., 1998); LTK63 (Ser to Lys) (Marchetti et al., 1998, Douce et al., 1997, 1998, Di Tommaso et al., 1996); and LTR72 (Ala to Arg) (Giuliani et al., 1998), Pertussis toxin, PT. (Lycke et al., 1992, Spangler BD, 1992, Freytag and Clemments, 1999, Roberts et al., 1995, Wilson et al., 1995) including PT-9K/129G (Roberts et al., 1995, Cropley et al., 1995); Toxin derivatives (see below) (Holmgren et al., 1993, Verweij et al., 1998, Rappuoli et al., 1995, Freytag and Clements, 1999); Lipid A derivatives (e.g., monophosphoryl lipid A, MPL) (Sasaki et al., 1998, Vancott et al., 1998; Muramyl Dipeptide (MDP) derivatives (Fukushima et al., 1996, Ogawa et al., 1989, Michalek et al., 1983, Morisaki et al., 1983); Bacterial outer membrane proteins (e.g., outer surface protein A (OspA) lipoprotein of *Borrelia burgdorferi*, outer membrane protine of *Neisseria meningitidis*)(Marinaro et al., 1999, Van de Verg et al., 1996); Oil-in-water emulsions (e.g., MF59) (Barchfield et al., 1999, Verschoor et al., 1999, O'Hagan, 1998); Aluminum salts (Isaka et al., 1998, 1999); and Saponins (e.g., QS21) Aquila Biopharmaceuticals, Inc., Worster, Mass.) (Sasaki et al., 1998, MacNeal et al., 1998), ISCOMS, MF-59 (a squalene-in-water emulsion stabilized with Span 85 and Tween 80; Chiron Corporation, Emeryville, Calif.); the Seppic ISA series of Montanide adjuvants (e.g., Montanide ISA 720; AirLiquide, Paris, France); PROVAX (an oil-in-water emulsion containing a stabilizing detergent and a micell-forming agent; IDEC Pharmaceuticals Corporation, San Diego, Calif.); Syntext Adjuvant Formulation (SAF;

Syntex Chemicals, Inc., Boulder, Colo.); poly[di(carboxylatophenoxy)phosphazene (PCPP polymer; Virus Research Institute, USA) and Leishmania elongation factor (Corixa Corporation, Seattle, Wash.).

[0165] Immune responses can also be induced or augmented by the co-administration or co-linear expression of cytokines (Bueler & Mulligan, 1996; Chow et al., 1997; Geissler et al., 1997; Iwasaki et al., 1997; Kim et al., 1997) or B-7 co-stimulatory molecules (Iwasaki et al., 1997; Tsuji et al., 1997) with the immunostimulatory nucleic acids and asthma/allergy medicaments. The cytokines can be administered directly with immunostimulatory nucleic acids or may be administered in the form of a nucleic acid vector that encodes the cytokine, such that the cytokine can be expressed in vivo. In one embodiment, the cytokine is administered in the form of a plasmid expression vector. The term "cytokine" is used as a generic name for a diverse group of soluble proteins and peptides which act as humoral regulators at nano- to picomolar concentrations and which, either under normal or pathological conditions, modulate the functional activities of individual cells and tissues. These proteins also mediate interactions between cells directly and regulate processes taking place in the extracellular environment. Examples of cytokines include, but are not limited to IL-1, IL-2, IL-4, IL-5, IL-6, IL-7, IL-10, IL-12, IL-15, IL-18 granulocyte-macrophage colony stimulating factor (GM-CSF), granulocyte colony stimulating factor (GCSF), interferon-γ (γ-IFN), IFN-a, tumor necrosis factor (TNF), TGF-β, FLT-3 ligand, and CD40 ligand. Cytokines play a role in directing the T cell response. Helper (CD4+) T cells orchestrate the immune response of mammals through production of soluble factors that act on other immune system cells, including other T cells. Most mature $CD4^+$ T helper cells express one of two cytokine profiles: Th1 or Th2. In some embodiments it is preferred that the cytokine be a Th1 cytokine.

[0166] The term "effective amount" of an immunostimulatory nucleic acid and an asthma/allergy medicament refers to the amount necessary or sufficient to realize a desired biologic effect. For example, an effective amount of an immunostimulatory nucleic acid and an asthma/allergy medicament for treating or preventing asthma or preventing is that amount necessary to prevent the development of IgE in response to an allergen or initiator upon exposure to the allergen or initiator is that amount necessary to cause the shift from Th2 to Th1 response in response to an allergen or initiator.

[0167] Combined with the teachings provided herein, by choosing among the various active compounds and weighing factors such as potency, relative bioavailability, patient body weight, severity of adverse side-effects and preferred mode of administration, an effective prophylactic or therapeutic treatment regimen can be planned which does not cause substantial toxicity and yet is entirely effective to treat the particular subject. The effective amount for any particular application can vary depending on such factors as the disease or condition being treated, the particular immunostimulatory nucleic acid or asthma/allergy medicament being administered (e.g. the type of nucleic acid, i.e. a CpG nucleic acid, the number of unmethylated CpG motifs or their location in the nucleic acid, the degree of modification of the backbone to the oligonucleotide the type of medicament), the size of the subject, or the severity of the disease or condition. One of ordinary skill in the art can empirically determine the effective amount of a particular immunostimulatory nucleic acid and/or asthma/allergy medicament and/or other therapeutic agent without necessitating undue experimentation.

[0168] Depending upon the aspect of the invention, the immunostimulatory nucleic acid and asthma/allergy medicament may be administered in a synergistic amount effective to treat or prevent asthma or allergy. A synergistic amount is that amount which produces a physiological response that is greater than the sum of the individual effects of either the immunostimulatory nucleic acid or the asthma/allergy medicament alone. For instance, in some embodiments of the invention, the physiological effect is a reduction in IgE levels. A synergistic amount is that amount which produces a reduction in IgE that is greater than the sum of the IgE reduced by either the immunostimulatory nucleic acid or the asthma/allergy medicament alone. In other embodiments, the physiological result is a shift from Th2 cytokines, such as IL-4 and IL-5, to Th1 cytokines, such as IFN-γ and IL-12. The synergistic amount in this case is that amount which produces the shift to a Th1 cytokine that is greater than the sum of the shift produced by either the immunostimulatory nucleic acid or the asthma/allergy medicament alone. In other embodiments the physiological result is a decrease in eosinophilia, hyperreactivity, or lung function.

[0169] In some embodiments of the invention, the immunostimulatory nucleic acid is administered in an effective amount for preventing bacterial or viral infection. Immunostimulatory nucleic acids are known to be useful for preventing bacterial and viral infections. Bacterial and viral infections exacerbate and/or induce allergy and/or asthma. In this aspect of the invention, the immunostimulatory nucleic acid is administered to the subject in an amount effective to prevent bacterial and viral infection and the asthma/allergy medicament is administered to the subject when symptoms of allergy or asthma appear. Thus, the immunostimulatory nucleic acid is administered to the subject and then the asthma/allergy medicament is subsequently administered to the subject or they are administered together at the same time. This method is particularly useful in subjects such as children and immunocompromised subjects, or elderly subjects, who are particularly susceptible to bacterial or viral disease.

[0170] In aspects of the invention directed at treating subjects in anticipation of an asthmatic or allergic event or season (e.g., in anticipation of the hay-fever season), the subjects may be administered an immunostimulatory nucleic acid in an effective amount for preventing the asthma or allergy. In related embodiments of this method, an asthma/allergy medicament is also administered to the subject. In these latter instances, the amount of the immunostimulatory nucleic acid administered may be that amount necessary to reduce the effective dose of the asthma/allergy medicament which is required to treat or prevent the asthma or allergy.

[0171] Thus, in these embodiments, the immunostimulatory nucleic acid potentiates the effect of the asthma/allergy medicament. The ability to potentiate the effect of an asthma/allergy medicament is useful since it allows for a reduction in the administered dose of an asthma/allergy medicament with the same or better therapeutic result. As an